# INVESTIGATOR'S ANNUAL REPORT

**National Park Service**

**All or some of the information provided may be available to the public**

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| **Reporting Year:**<br>1997 | **Park:**<br>Shenandoah NP |
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**Permit#:**
SHEN1997AULO

**Park-assigned Study Id. #:**
unknown

**Project Title:**
Assessment Of Biodiversity Associated With Eastern Hemlock Forests (N-224)

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| **Permit Start Date:**<br>Jan 01, 1998 | **Permit Expiration Date**<br>Jan 01, 1998 |
| **Study Start Date:**<br>Jan 01, 1996 | **Study End Date**<br>Jan 01, 1998 |

**Study Status:**
Completed

**Activity Type:**
Research

**Subject/Discipline:**
Ecology (Aquatic, Marine, Terrestrial)

**Objectives:**

The Pennsylvania State University (Penn State) in cooperation with the National Park Service (Yahner et al. 1996) have initiated a research project to assess the biodiversity associated with hemlock and complementary paired hardwood ecosystems at SHEN. The goals of year one of this project were to (1) assemble and synthesize existing information on terrestrial floral and faunal diversity at DEWA and SHEN, (2) develop and establish study site design for forest stands at SHEN, (3) develop and standardize specified field protocols and procedures for a biodiversity inventory in hemlock and complementary hardwood ecosystems at DEWA and SHEN, and (4) conduct prelimnary biodiversity sampling at two forest stands at SHEN. ***Specimens collected during sampling are stored as follows: Mammals/amphibians: Shippensburg Vertebrate Museum, Shippensburg U., Shippensburg, PA; Plants: Carnegie Museum; Inverts: Frost Museum, Penn State University.***

**Findings and Status:**

To meet the first objective, we compiled information from existing reports, publications, museums, and databases (including NP Flora/Fauna) on terrestrial floral and faunal biodiversity found in and around DEWA and SHEN (Mahan 1997a, 1997b). Biodiversity information was integrated with existing data in a newly created computerized database using Microsoft Access (termed the Biodiversity Database). Biodiversity information was collected for amphibians, reptiles, birds, mammals, vascular and non-vascular plants, and invertebrates. The Biodiversity Database contains over 8,000 and 1,500 species of invertebrates that potentially could be located at DEWA and SHEN, respectively. The Biodiversity Database was installed at DEWA and SHEN in 1997. ; To meet the second objective, USGS BRD researchers developed a landscape analysis methodology to select forest stands for conducting biodiversity inventories (Smith et al. 1996). Stand boundaries at DEWA and SHEN were defined using forest cover-type maps provided by resource managers at each park (Myers and Irish 1981, Teeter 1988). Geographic Information System (GIS) methods were used to tabulate landscape attributes of hemlock stands. Hemlock stands were clustered into three topographic types based on their landscape attributes generated from a 1:24,000 digital elevation model (USGS topography) (Smith et al. 1996). Landscape attributes used for classifying and clustering hemlock stands included: elevation, percent slope, aspect, and terrain shape (Smith et al. 1996). Hemlock stands in each topographic type were then paired with hardwood forest stands using multivariate distance based on similar landscape attributes. Potential study stands were visited at DEWA and SHEN to check the appropriateness of using the proposed methodology to stratify stands based on topographic type. As of February 1997, fourteen and seven

pairs of hemlock and hardwood forest stands were selected as potential study sites at DEWA and SHEN, respectively (Mahan 1997c, 1997d). ; For objective 3, a manual that details standardized field protocols for inventorying terrestrial and aquatic flora and fauna was prepared (Mahan et al. 1997). Protocols for terrestrial floral and faunal inventories were standardized and developed by researchers at Penn State. Protocols for aquatic sampling were standardized and developed by researchers from USGS BRD (Ross et al. 1996). Currently, the protocol manual is being reviewed by resource managers and DEWA and SHEN and researchers associated with the Smithsonian Institute's Man and the Biosphere Program (SI/MAB) (see Dallmeier 1992). ; To meet objective four, we collected biotic data on mammals, amphibians, plants, and invertebrates from the forest soil to the canopy SHEN. We sampled within a 20 x 20 m ecosystem profile plot and throughout the stand in both a hemlock forest and a reference, non-hemlock (hardwood) forest. The hardwood reference stand was paired with the hemlock forest stand based on similarity of geographic features such as elevation, slope, aspect, and topographic shape. Although overall species diversity was higher in the hardwood forest, the hemlock forest was associated with higher numbers of red-backed salamanders (Plethodon cinereus) and red-backed voles (Clethrionomys gapperi). Small mammals were parasitized by bot fly larvae more frequently in the hardwood forest than in the hemlock forest. In addition, invertebrate communities of plecoptera, trichoptera, and psocoptera were more common in the hemlock forests. Furthermore, the hemlock forest was characterized by greater canopy closure, lower incident light, and more acidic soils than the hardwood forest. We believe that the ecosystem profile approach is providing us with a more complete description of the community structure within hemlock ecosystems and will furnish us with valuable information for future monitoring and restoration of these threatened ecosystems. ;

**For this study, were one or more specimens collected and removed from the park but not destroyed during analyses?**

Yes

| **Funding provided this reporting year by NPS:** | **Funding provided this reporting year by other sources:** |
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| 120000 | 0 |

**Fill out the following ONLY IF the National Park Service supported this project in this reporting year by providing money to a university or college**

| **Full name of college or university:** | **Annual funding provided by NPS to university or college this reporting year:** |
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| THE PENNSYLVANIA STATE UNIVERSITY | 120000 |